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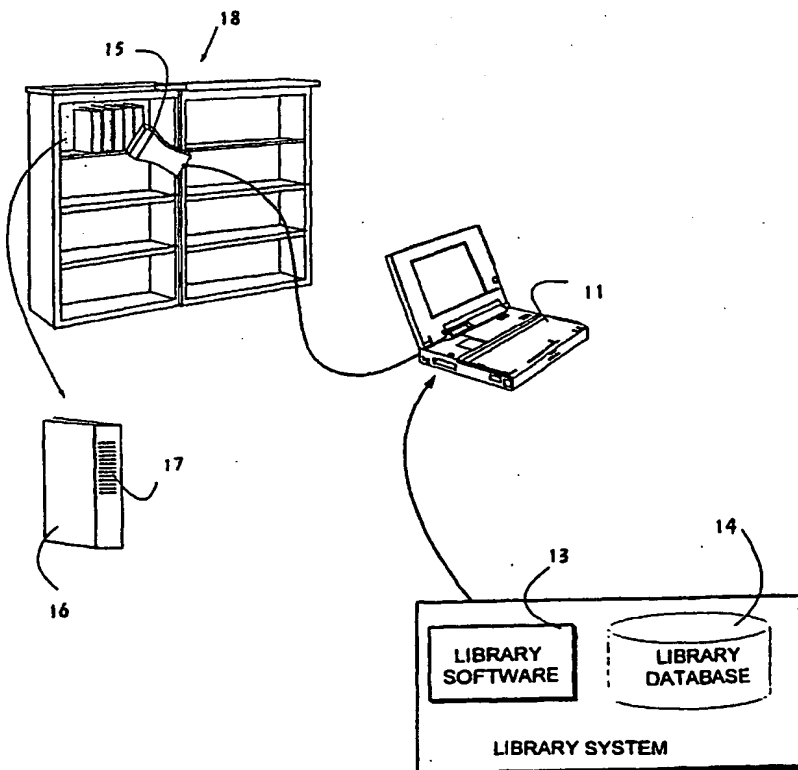
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(54) Title: **SYSTEM AND METHOD OF INVENTORY OF ARCHIVE**



(57) Abstract: An object of the invention is a system for archives, especially for libraries, which make possible to clear up the items, like books, absent from shelf and the reason of the absence and which notifies exactly where to move a book under consideration if it is not in proper position. A basis of the invention is that an existing database (14) of a library contains data of all the books arranged alphabetically by class and the data of the books on loan. This data is transferred to a terminal equipment (11). A bar code (17) identifying the book is attached on the back of each book, and the data of the books on shelves are read in succession by a bar code reader (15) connected to the terminal equipment. As a bar code is read, an application program in the equipment compares the data of a book with the data of the database of the library program and calculates, on the basis of bar codes and the data of the database, if a book is in the proper position thereof in relation to other books and if an absent book is missing.

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*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

## System and method of inventory of archive

### Technical Field

The invention is related to inventory of an archive which consists of a plurality of items  
5 signed by a bar code, each item having its own position in the archive. Especially, the invention is related to inventory of books placed on shelves of a library.

### Background Art

It is well known that items like folders or equivalent are placed in an archive in which  
10 the position of an item in relation to other items is exactly determined. For maintenance of large archives, a special electrical card file, i.e. database, which includes data of the items of the archive, and an application program by means of which a user is able to make searches, are used. By means of the program the user may easily find the position of a desired item in the archive and then go to the archive to fetch the item.

15 An example of a widely used archive is library. The objects to be filed are books, disk records, CD disks, etc. which are classified to main classes and subclasses. For the sake of clarity, below herein only books are spoken about. The books are placed on the shelves according to said classification. When searching a book, a user inputs to a library program the data of the book which he or she remembers. If the data input is enough, the library  
20 program is able to directly fetch the data of the book and the classification data thereof. Additionally, the program indicates if the book may be borrowed, i.e. is on shelf, or if it is on loan. On the basis of the classification data, the user is able to find the book from the proper position. If the book is borrowed, the bar code on the back cover of the book is read whereby the data of the borrower and of the book are input to the library program.

25 A book may be away from a shelf also for library staff measures, e.g. repairing or indexing. Then, an employee of the library inputs the necessary data to the program.

In conclusion, a library program should always have real time data of the state of all the books of the library, i.e. is a book on shelf, and if not, is it on loan or taken away by the staff.

30 A problem is, however, that in practice a library program does not provide exact data of the state of the books of a library. The books of a library are difficult to inventory because, in spite of precautionary measures, books are stolen, they may be on a wrong shelf or in a wrong position on the shelf thereof, or a book may be taken away from shelf by the staff without inputting data to the system. Because one can not be sure that all the books which  
35 the library program notifies are present on shelf really are on shelf and in proper positions on the shelves, the whole library must, from time to time, be gone through manually, the books

located in wrong positions be moved to proper positions, the lost books be indexed, and finally the library program be updated. The larger the library is, the more troublesome this work is.

To alleviate this problem, a plurality of systems based on bar codes are developed. One such system is presented in JP patent 2245966. In the system described therein, each shelf is provided with an identification number presented by a bar code. Additionally, the back of each book is provided with a bar code identifying the book. By means of a bar code reader connected to a portable data terminal equipment, the bar code of the shelf is first read and saved in a shelf number memory of the equipment. Thereafter, the bar code of a book on this shelf is read from the back thereof, and the numeric data included therein is transferred to the controller of the equipment. For each book, the numeric data of a shelf on which the book should be positioned is saved beforehand in the memory of the equipment. The controller makes a query to the memory and, in response thereto, returns the numeric data of the shelf in which the book just read by the bar code reader should be positioned. This numeric data is compared with the numeric data saved in the shelf number memory. If the comparison indicates that the data are different, the numeric data of the shelf to which the book belongs is given on the display of the equipment. Thereafter, the user of the equipment moves the book to the proper position thereof. If the data are identical, the bar code from the back of the next book may be read.

A drawback of this system is that it gives the data of only a book which really is on shelf, i.e. the data of the book the bar code of which is just read. The system does not provide information about the possible absence of a book and the reason therefor. Moreover, it provides the data of a proper position with the accuracy of one shelf, only, whereby the user must locate the book according to alphabetic order in a proper position on the shelf given by the system.

### **Disclosure of Invention**

An object of the invention is a system which make possible to clear up the items absent from a shelf and the reason of the absence and which notifies exactly where to move an item under consideration if it is not in proper position.

The invention is based on perceiving that the data contained by an archive program are moved to a separate terminal equipment. The archive program contains data of all the items arranged alphabetically by class and the data of the items on loan. A bar code identifying the item is attached on the back of each item, and the data of the items on a shelf are read in succession by a bar code reader connected to a terminal equipment. A desired number of data sets of the items already read are kept saved in a memory.

As the data of a new item is read, an application program in the equipment compares the data of the item with the data of the archive program. If, according to the archive program, the item is on shelf and follows immediately the item read previously and saved in the memory, the item is in the proper position. If, according to the archive program, the item is in the proper position thereof but it should not be on shelf, the user is immediately informed of the entered reason of the absence of the item.

If an item is absent between the item just read and the item previously saved in the memory, the application program is examining from the archive program if the item absent is on loan. If so, all is in order. If not, the application program provides the user with a notification that the item is missing. A reason may be that it is stolen. The user may then check again if he or she perhaps omitted to read an item by the bar code reader.

If the item just read is not that one which it should be according to the archive program, the application program calculates the position thereof and provides the user with the information of the position to which the item is to be moved, e.g. "move the item over 6 items to the left" or "move the item to shelf S".

As the shelves are gone through in succession in this way, the proper knowledge of the real state of the archive is obtained, and at the same time the items placed in wrong positions may be moved to their proper positions.

### **Brief Description of Drawings**

In the following, the invention is described in further detail with reference to the accompanied schematic drawings, in which:

Fig. 1 presents the operation principle of the invention;

Fig. 2 presents books placed on a shelf; and

Fig. 3 presents a possible flow chart of the program.

### **Modes for Carrying Out the Invention**

The invention is described in further detail using a library as an example whereby an item means any item preserved by a library, like a book, disk record, CD disk, etc. For the sake of clarity, only books are spoken about here below. Reference sign 18 indicates shelves of a library, in general. The books are placed on the shelves according to a general classification system, and within a subclass, in alphabetic order by author, in most cases. On the back of each book 16 a bar code 17 is attached which includes the same basic data about the book as what is saved in an as such known library system 12 used by the library.

In the library system, an archive program of which contains a software 13 and a database 14, there is the data of each book by class, and within the classes the data of the

order of the books. This order corresponds to the order of the books on the shelves. Additionally, the database contains the data indicating if a book is on shelf or on loan. The data of the database 14 is transferred to a portable terminal equipment, e.g. to a memory of a computer 11, by wired data transfer via a serial port, radio connection, IR connection, or data connection via Internet if the database is physically far away.

To the portable computer 11 a hand-held bar code reader 15 is connected by which bar codes of the books of a shelf are read in succession. The read bar code is entered to the computer 11.

The computer contains an application program which, in response to the entered bar code, carries out the operations described here below.

These operations are described with reference to Figs. 2 and 3. Fig. 2 illustrates books on a shelf. A letter on the back of each book refers to an identifier of the book which is marked by a bar code. Fig. 3 is a possible flow chart of the operation of the application program. Let us assume that reading is started from left from book A, and book F is under consideration. After the reading in phase 310, the application program fetches, in phase 311, the data of the book corresponding to said code F from the database of the library program transferred to the equipment.

If it is apparent that the book also according to the database should be on shelf, it is checked, in phase 312, if book F is in proper order, i.e. if the data of book F follows the data of the book checked previously (irrespective of it being on shelf or not). This is made so that the data is compared with the data related to the previous readings and with the data of the database. If book F is, according to the database, following book E (irrespective of it being on shelf or not), the position is proper and the bar code of the next book H is read.

Phases 311 and 312 are gone through again whereby in phase 312 it is observed that the order is not proper. Next, it is examined if a book is absent therebetween. According to the database, book G should be therebetween to make the order proper. Now, it is examined, in phase 314, if it is on loan. If so, one goes on to read the bar code of the next book. If, on the other hand, book G is not on loan and is still absent, it is marked to be missing in phase 315.

The procedure is continued until book X is read. Now, the result of phase 313 gives the information that no book is absent therebetween. Thereby it is known that the position of book X is not proper. On the basis of the data of the database and the data of the previous readings, it is calculated, in phase 316, where to the book is to be moved. The result of the calculation is notified to the user on the display in phase 317. The result may be, for example, an instruction to "move the book in order over 6 books to the left". After the movement of the book, the bar code of book K is read.

In this way all the books are gone through, and the proper knowledge of the state of the library is obtained.

The flow chart of Fig. 3 is extremely simplified and intended only to illustrate the idea of the invention. In practice, the procedure of the program may be implemented in such a way that all the books are read first, and then the application program processes the data and provides an output which notifies the missing books and the books the position of which is wrong and gives the instructions for positioning the books again.

The terminal equipment is not necessarily a portable computer but may be any terminal equipment able to receive and save the data given by a bar code reader. Accordingly, it may be even far away from the reader which transfers the data thereto via a wired or wireless connection or a combination thereof. So, the data transfer connection between the terminal equipment and the bar code reader may include a plurality of intermediate networks. The terminal equipment may be also a part of the ordinary data processing system of an archive.

Instead of a hand-held bar code reader, the reading of the bar codes may be arranged by installing a sliding rail before the books, the reader sliding on the rail. Also, it is possible to save the read data in a memory located in the bar code reader from which they are unloaded later to a terminal equipment for further processing.

### **Industrial Applicability**

The invention is described above using a library as an example but it is apparent that it may be applied to any archive like system in which the items have an exactly defined position in relation to each other. With the new technique of the invention, inventories of archives may be made more frequently and are not as laborious as earlier. The invention improves the data processing systems of archives and makes the operation and control thereof more reliable.

## Claims

1. A system for inventory of an archive which consists of a plurality of items placed on shelves next to each other in a determined order and signed by a bar code, a separate item  
5 database being maintained of the archive containing data of the items, data of the mutual order of the items, and data indicating if an item is on shelf or on loan, **characterized** in that the system includes:

a terminal equipment (11) to a memory of which the item database (14) is transferred;

10 a bar code reader (15) which is connected with a data transfer connection to the terminal equipment for reading in succession the bar codes (17) of the items (16) on the shelves and for transferring the read bar codes to the terminal equipment; and

an application program in the terminal equipment for calculating, on the basis of the bar codes of the items and the data of the item database, if an item is, in relation to  
15 other items, in the proper position thereof and if an absent item is missing.

2. A system according to claim 1, **characterized** in that the application program, in response to finding that an item is in wrong position, calculates the proper position thereof and notifies the data of the proper position to a user.

20 3. A system according to claim 1, **characterized** in that first the bar codes of all the items are read to the memory of the terminal equipment, and the processing of the data by the application program is started thereafter.

25 4. A system according to claim 1, **characterized** in that items of an archive include books and electrical and other records of a library, and that the data of the mutual order is data of the alphabetic order of the items.

30 5. A method of inventory of an archive which consists of a plurality of items placed on shelves next to each other in a determined order and signed by a bar code, a separate item database being maintained of the archive containing data of the items, data of the mutual order of the items, and data indicating if an item is on shelf or on loan, **characterized** in that:

the data of the item database (14) is transferred to a memory of a terminal  
35 equipment (11);



bar codes (17) of the items (16) on the shelves are read in succession by a bar code reader (15);

the read bar codes are transferred via a data transfer connection to the terminal equipment; and

5           by using an application program it is calculated, on the basis of the bar codes of the items and the data of the item database, if an item is, in relation to other items, in the proper position thereof and if an absent item is missing.

10       6. A method according to claim 5, **characterized** in that if an item is in wrong position, the proper position thereof is calculated by using the application program and the data of the proper position is notified to a user.

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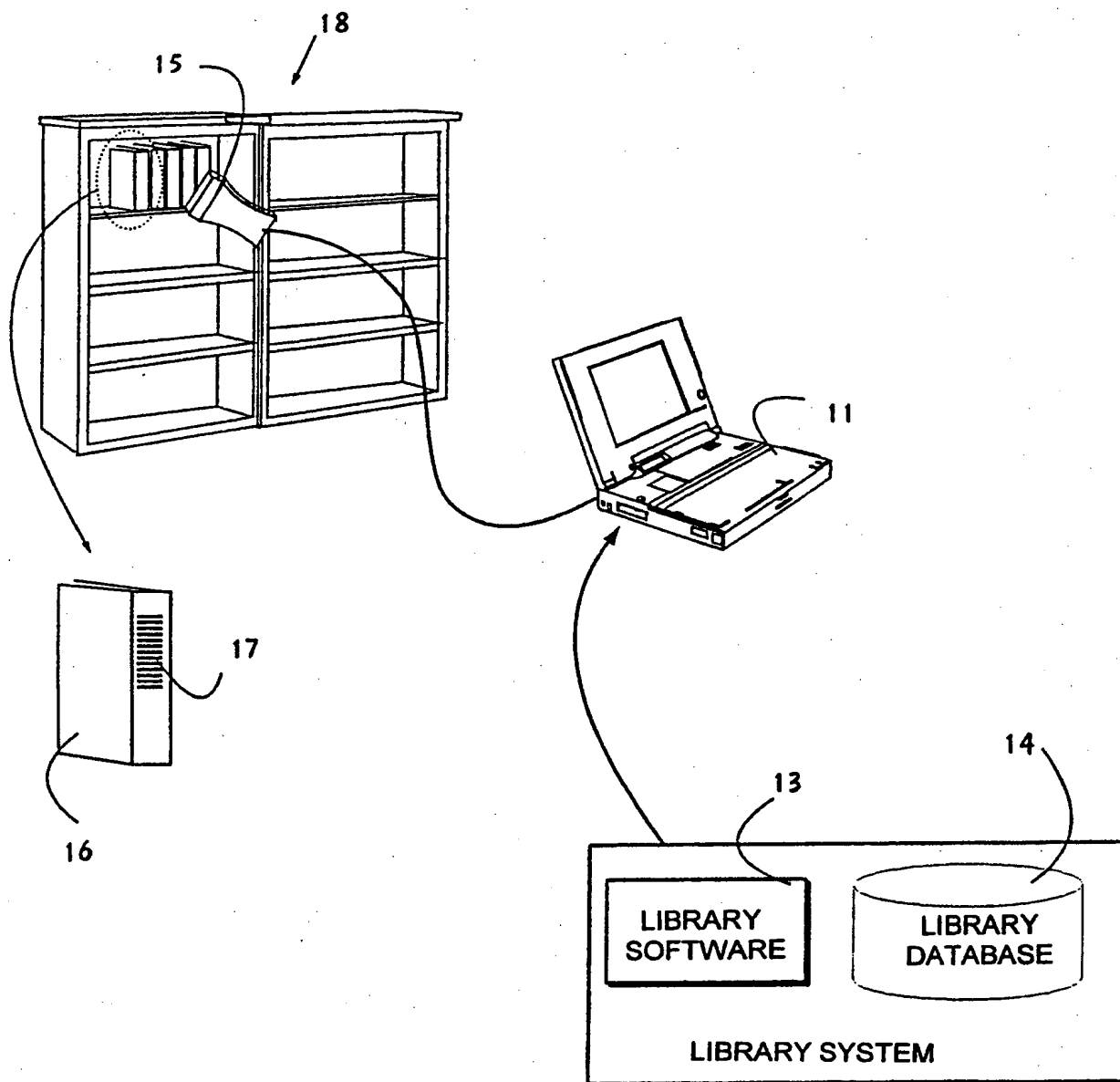


Fig. 1

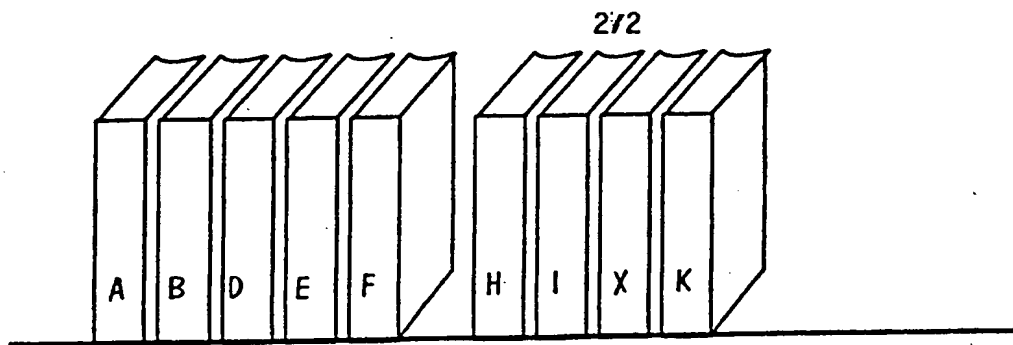


Fig. 2

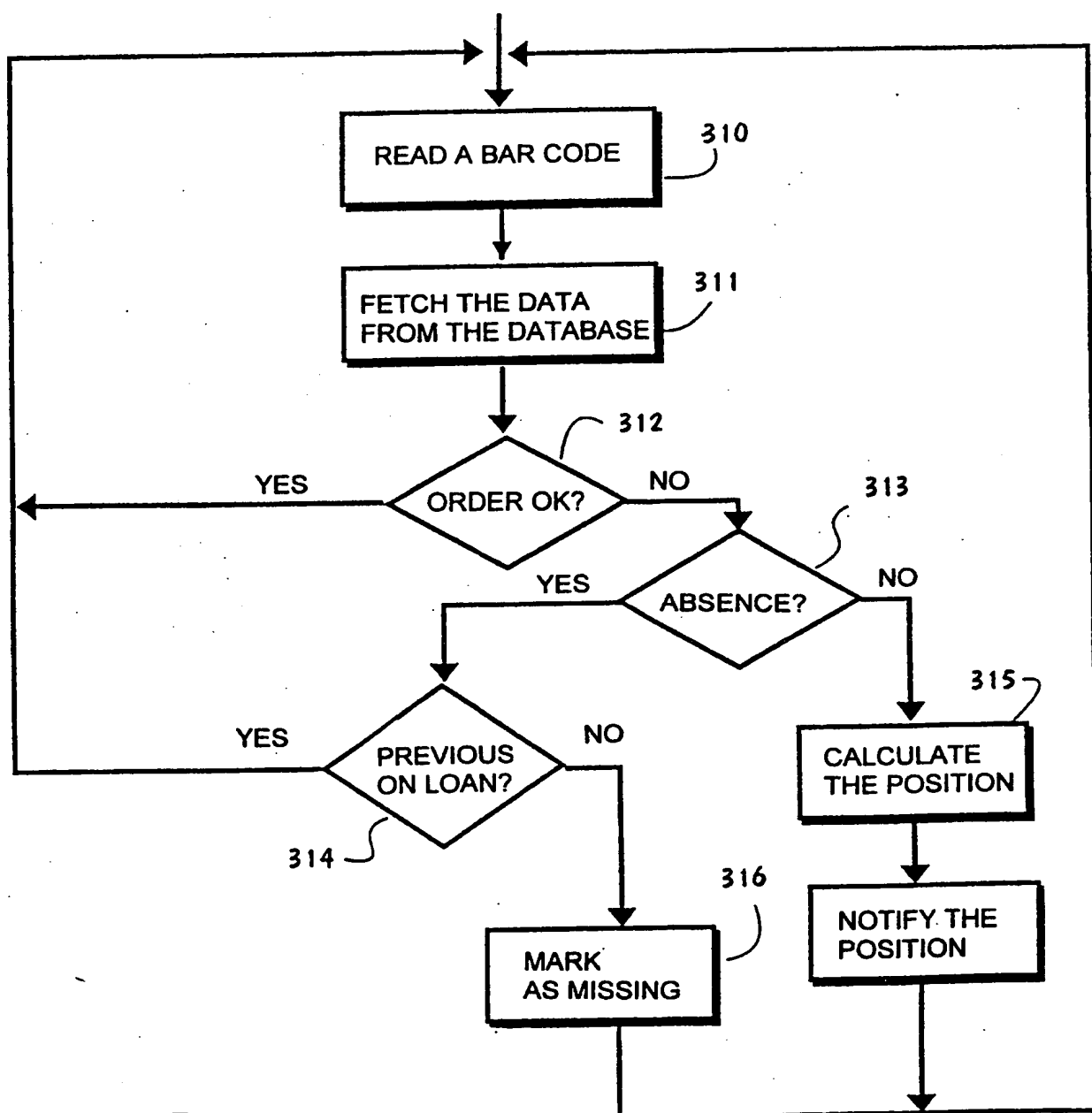


Fig. 3

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 00/00505

## A. CLASSIFICATION OF SUBJECT MATTER

IPC7: G06F 19/00 // G06F 153:00

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0640966 A2 (INTERNATIONAL BUSINESS MACHINES CORPORATION), 1 March 1995 (01.03.95), column 1, line 32 - line 52; column 5, line 22 - line 43, claims 1,5,7-8, abstract --	1-6
X	US 5729464 A (KAMAL DIMITRI), 17 March 1998 (17.03.98), column 2, line 30 - line 36, claim 1, abstract --	1-6
P,X	US 6014675 A (VICKIE BREWER ET AL), 11 January 2000 (11.01.00), column 2, line 54 - column 3, line 47, claim 1, abstract --	1-6

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

- \* Special categories of cited documents:
- "A" document defining the general state of the art which is not considered to be of particular relevance
  - "E" earlier document but published on or after the international filing date
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  - "O" document referring to an oral disclosure, use, exhibition or other means
  - "P" document published prior to the international filing date but later than the priority date claimed

- "I" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
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Date of the actual completion of the international search

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## INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 00/00505

## C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5323327 A (LARRY CARMICHAEL ET AL), 21 June 1994 (21.06.94), figure 1, abstract  -- -----	1-6

# INTERNATIONAL SEARCH REPORT

Information on patent family members

01/08/00

International application No.

PCT/FI 00/00505

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US	6014675	A	11/01/00	NONE		
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US	5323327	A	21/06/94	NONE		
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